

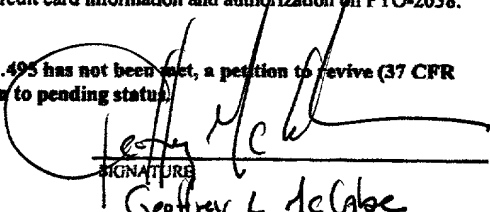


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FORM PTO-1300 (REV. 11-2000)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				U.S. APPLICATION NO. (If known, rec. 37 CFR 1.5)	
INTERNATIONAL APPLICATION NO. PCT/US98/20376		INTERNATIONAL FILING DATE 29 September 1998		PRIORITY DATE CLAIMED	
TITLE OF INVENTION Tuning Apparatus For Stringed Instrument					
APPLICANT(S) FOR DO/EO/US McCabe, Geoffrey L					
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:					
<p>1. <input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</p> <p>2. <input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.</p> <p>3. <input type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.</p> <p>4. <input type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (Article 31).</p> <p>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))</p> <p>a. <input type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau).</p> <p>b. <input type="checkbox"/> has been communicated by the International Bureau.</p> <p>c. <input checked="" type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</p> <p>6. <input checked="" type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).</p> <p>a. <input type="checkbox"/> is attached hereto.</p> <p>b. <input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4).</p> <p>7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))</p> <p>a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau).</p> <p>b. <input type="checkbox"/> have been communicated by the International Bureau.</p> <p>c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</p> <p>d. <input type="checkbox"/> have not been made and will not be made.</p> <p>8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).</p> <p>9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</p> <p>10. <input type="checkbox"/> An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</p>					
Items 11 to 20 below concern document(s) or information included:					
11. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.					
12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.					
13. <input type="checkbox"/> A FIRST preliminary amendment.					
14. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.					
15. <input type="checkbox"/> A substitute specification.					
16. <input type="checkbox"/> A change of power of attorney and/or address letter.					
17. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.					
18. <input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4).					
19. <input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).					
20. <input type="checkbox"/> Other items or information:					

U.S. APPLICATION NO. <b>09/830279</b>		INTERNATIONAL APPLICATION NO.		ATTORNEY'S DOCKET NUMBER	
21. <input checked="" type="checkbox"/> The following fees are submitted: <b>BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):</b> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... \$1000.00  International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... \$860.00  International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$710.00  International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... \$690.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$100.00 <b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>				<b>CALCULATIONS PTO USE ONLY</b>          <div style="border: 1px solid black; padding: 2px; display: inline-block;">             \$ 100           </div>	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$	
<b>CLAIMS</b>	<b>NUMBER FILED</b>	<b>NUMBER EXTRA</b>	<b>RATE</b>	<b>\$</b>	
Total claims	- 20 =	19	x \$18.00	\$ 342	
Independent claims	- 3 =	8	x \$80.00	\$ 640	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)				+ \$270.00	
<b>TOTAL OF ABOVE CALCULATIONS =</b>				\$ 982	
<input checked="" type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				+ \$ 491	
<b>SUBTOTAL =</b>				\$ 491	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$ 0	
<b>TOTAL NATIONAL FEE =</b>				\$ 491	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +				\$ 40	
<b>TOTAL FEES ENCLOSED =</b>				\$ 531	
				Amount to be refunded:	\$
				charged:	\$
a. <input type="checkbox"/> A check in the amount of \$ _____ to cover the above fees is enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. _____. A duplicate copy of this sheet is enclosed. d. <input checked="" type="checkbox"/> Fees are to be charged to a credit card. <b>WARNING:</b> Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.					
<b>NOTE:</b> Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.					
SEND ALL CORRESPONDENCE TO: <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">           Geoffrey L McCabe            6124 Glen Tower            Hollywood, CA 90068            USA         </div> <div style="width: 45%; text-align: center;">             SIGNATURE            Geoffrey L McCabe            NAME         </div> </div> <div style="text-align: right; margin-top: 10px;">           REGISTRATION NUMBER _____         </div>					

## TUNING APPARATUS FOR STRINGED INSTRUMENT

### BACKGROUND OF THE INVENTION

In a stringed musical instrument, such as a guitar, the strings extend unsupported between a first critical point usually formed by the nut where the neck joins the head and a second critical point usually formed by the bridge positioned on the body. The strings are anchored at one end on a portion of the instrument known as the tailpiece, strung over the bridge and the nut on the head of the instrument and in conventional instruments anchored on the other end to the tuning pegs where an untensioned string is tensioned and adjusted to a tuned condition. The second critical point is formed by a part of the bridge or by a part of a combined bridge and tailpiece structure. Traditionally, the size of the bridge elements are quite small so as to create a clearly defined single point of contact between the string and the bridge element. It is between these two points that the string length is determined. This is sometimes referred to as the scale length. Adjusting the relative distance between the first and second critical points is called harmonic tuning. Some bridge structures have individually adjustable bridge elements for each string. Often the typical construction of the strings, particularly for guitar and bass, have a plain end and a "ball end" in which a washer-like addition is wrapped by the string itself as a means to help in securing the string to the instrument on the tailpiece. The wrapping is typically thicker than the rest of the string so that the wrapping is substantially inextensible. The wrapping usually extends for at least a 1/2" towards the plain end and as such the tailpiece structure must insure that the wrapping does not extend over the second critical point when arranged on the instrument. Fine tuning has been a long standing problem for stringed musical instruments. In the Proelsdorfer U.S. Pat. No. 2,304,597, string tensioning devices placed on the tailpiece for fine tuning the pitch of the strings of violins, guitars and the like, were disclosed, however such pitch adjustment is quite limited in range and designed to offer the tuning of the strings a minor adjustment of pitch after the general tuning is achieved with the tuning pegs on the head of the instrument which first provides the means

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for raising and adjusting the tension of the strings to pitch from an untensioned condition.

It is known to those skilled in stringed musical instrument design and construction that various tremolos have been proposed and utilized for varying the tension of all the strings simultaneously for the purpose of creating a tremolo sound. Further, it is known to those skilled in the art that there are a great many commonly used names for such devices, such as tremolo, tremolo device, tremolo tailpiece, tremolo bridge, fulcrum tremolo, fulcrum tremolo bridge, fulcrum tremolo tailpiece, fulcrum tremolo bridge-tailpiece, vibrato, vibrato bridge, vibrato tailpiece, vibrato bridge tailpiece, etc.

In one specific species, known as the fulcrum tremolo, Fender U.S. Pat. No. 2,741,146, shows and provides a tremolo device which incorporates a novel bridge structure which incorporates the tailpiece and is commonly known to specifically provide the anchoring means for the strings. The bridge plate is also known as the base plate. The base plate upon which the individual bridge elements are adjustably secured has a beveled ridge portion which is secured to the instrument body by six screws for permitting pivotal movement about a fulcrum axis which varies the tension on the strings and produces the desired tremolo effect. The tailpiece is integrated into a spring block descending from the base plate into a cavity within the instrument body. Further, the bridge and the tailpiece both move together as the tremolo device is pivoted. The ball ends and wrapping of the strings are anchored into the recesses in the end of the string block furthest from the base plate. The strings being threaded through bores individual to each string over two inches in length within the spring block continuing out through the bottom of the base plate and over the bridge elements towards the nut. A singular aspect of the fulcrum tremolo is that the harmonic tuning is upset as the device is pivoted.

Typically, when a fulcrum tremolo pivots about its fulcrum axis, counter springs are utilized to counteract the pull of the strings. Counter springs are usually connected to the body of the instrument at one end and to an attachment means on the bottom of the tremolo at the other end. One of the most troublesome problems with prior art has been maintaining the initial

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tuning at proper playing pitch. When a musician plays on the string there is usually some kind of string stretch over time that results in the overall tuning going out of balance. Similarly, the use of the tremolo itself may also introduce string stretch. Further, various factors such as the changes in the humidity of the atmosphere causing the wood in the neck and/or body of the instrument to swell often create subtle distortions in the instrument's geometry which would then in turn disturb the equilibrium point between the tension of the strings and the tension of the counter springs and then as a consequence disturb the initial position. Initial position refers to a specific equilibrium point between the tension of the strings and the tension of the counter springs at the intended tuned pitched condition of the strings. Often the pivot means is subject to wear and the tremolo does not always return to its initial position. For the distance from the bridge elements to the anchoring points, there is an additional amount of unplayable string that is further subject to stretch. Where such demands on the tremolo are minimal this disadvantage is often traded-off for the advantage this extra length contributes as a "looser" feel in playing the instrument.

Improvements to the Fender U.S. Pat. No. 2,741,146 fulcrum tremolo have included using string clamps at the nut and immediately behind the intonation points on each of the bridge elements to limit string stretch to within these two points that define the scale length and separately adopting a novel beveled edge adjustably supported by two screw-like members positioned in the body at the fulcrum point to improve the return to initial position after pivoting the tremolo device (Rose U.S. Pat. No. 4,171,661). In Rose U.S. Pat. No. 4,497,236 a combination of the bridge element, the tailpiece and fine tuners replaced the "novel bridge structure" incorporating the tailpiece of the Fender device and Rose U.S. Patent No. 4,171,661 so that within the limited range (typically less than a whole tone) the strings could be re-tuned without unlocking the string clamps at the nut. However, string stretch beyond the range of the fine tuners necessitated a correction that is tedious and time consuming involving unlocking the string clamps, re-tuning the strings, re-adjusting the clamp, and re-tuning all the other strings to re-balance the

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equilibrium point back to initial position.

Therefore, for stringed musical instruments, as is known to those skilled in the art:

- 5           •       the second critical point is a clearly defined point on the bridge or individual bridge elements, the adjustment of which relative to the first critical point on the nut defines the length of the string or scale length and is called harmonic tuning; for fulcrum tremolos as originated by Fender U.S. Pat. No. 2,741,146 , when pivoted:
- 10           •       both the bridge portions and the string anchoring means, the tailpiece, simultaneously move about a fulcrum axis;
- there is a tendency for the harmonic tuning to be upset; and
- various factors can disturb the equilibrium point between the tension of the strings and the tension of the counter springs and  
15           as a consequence disturb the initial position; and for those fulcrum tremolos equipped with fine tuners as with Rose U.S. Pat. No. 4,497,236, Storey U.S. Pat No. 4,472,750 and Fender U.S. Pat No. 4,724,737:
- 20           •       the fine tuners simultaneously move with the bridge and tailpiece portions about the fulcrum axis when the device is pivoted; and
- fine tuners are designed to offer the tuning of the strings a minor adjustment of pitch after the general tuning is first  
25           achieved by the tuning pegs on the head of the instrument; and for those fulcrum tremolos fitted with string locks at the first and second critical points as in Rose U.S. Pat. No. 4,171,661,
- string stretch beyond the clamps at the first and second critical points is eliminated offering the most stability of tuning possible  
30           for the set of problems associated with string stretch.

In Steinberger U.S.Pat No. Re. 31, 722 stringed musical instruments without tuning pegs placed in the typical fashion on the head of the instrument

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were commonly known as "headless" stringed musical instruments. The replacement tuning machines were mounted on the body opposite the side where the neck joins the body.

In Takabayashi U.S. Pat No. 4,608,905 describes an improvement on  
5 fulcrum tremolos incorporating "octave tuners", tuners which functioned as the tuning pegs at the head of the instrument and as such integrated the tailpiece function in the tuning means. The bridge portion of the device comprised a "roller" configuration for the second critical point similar to Storey U.S. Pat No. 4,742,750 and Steinberger U.S. Pat No. 4,704,936. A cylindrical portion  
10 distanced from the bridge portion adjustably secured to the base plate houses a string holder member for one end of the string which is "fitted in such a manner as to be allowed to move freely in the axial direction". The ball end of each string is arranged to be anchored "to the rear end opening of the string holding members" which is adjustably positionable "in the stretching direction  
15 of the strings for effecting octave tuning". The string continues through the string holder member sufficient in size to ensure that the wrapping of the ball end does not extend over the second critical point and then passes on over the bridge element towards the nut. In this device the string holder member accomplishes the tailpiece function by anchoring the string at a single point  
20 which moves accordingly when the string holder member is displaced to achieve the tuning of the instrument.

Further improvements in the fulcrum tremolo utilized an arrangement with ball bearings at the pivot point within a housing adjustably mounted to the body which not only improved return to initial position after use of the  
25 tremolo but also virtually eliminated the wear and tear associated with prior art (McCabe U.S. Patent Application No. 07/607,458, Continuation No. 08/027,729, filed 1/14/93).

Additionally, the replacement of fine tuners with macro-tuners on a fulcrum tremolo (McCabe U.S. Patent Application No. 07/607,458,  
30 Continuation No. 08/027,729, filed 1/14/93) provided an intonation module that included a novel integrated one piece bridge-tailpiece structure secured to the base plate where each string anchored within its respective structure passes

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through a separate lever member and over the bridge element wherein the lever member could be displaced by an adjustment bolt to provide the means to bring and adjust the strings to playing pitch from an untensioned condition circumventing the re-tuning limits imposed by the fine tuner arrangements.

- 5 These macro-tuners are often part of an intonation module dedicated to each string for use with but not exclusive to "headless" stringed musical instruments, that is, instruments without tuning pegs placed in the typical fashion on the head of the instrument. Certainly, a fulcrum tremolo with macro-tuners could be used with instruments which had tuning pegs without a disadvantage.
- 10 Further, macro-tuners could be placed on the head or the body of the instrument and if integrated with a string anchoring means could replace the tuning pegs.

- Macro-tuners refer to tuners with the capacity to raise and adjust the tension of the strings from an untensioned condition to a proper playing pitch, and as such provide for alternate tunings and compensation for substantial string stretch during the life of the string essentially without additional means.
- 15

- Often the musician is called upon to play in an ensemble where the other instruments are not tuned to a typical concert pitch. Accordingly, the musician must flatten or sharpen the initial tuning of all the strings on his instrument in order to meet the pitch requirements of other instruments. This re-tuning often disturbs the initial position because the tension of the counter springs has not been readjusted as well. Accordingly, the position of the base plate of the tremolo is either tilting away from or towards the body of the instrument which then can limit the range in which the tremolo can be
- 20 activated. Steinberger U.S. Pat. No. 4,632,005 and Gunn U.S. Pat. No. 4,955,275 provide for an adjustable counter spring and utilize an adjustment knob that provides a means to vary tension of the counter spring and thereby maintain the equilibrium point between the tension of the counter spring and the tension of the strings on fulcrum tailpiece tremolo, that is, a tremolo device
- 25 where the bridge elements do not pivot with the anchoring means and, therefore, do not upset the harmonic tuning as such.
- 30

The "octave tuners" of the Takabayashi fulcrum tremolo US Pat No.



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4,608,905 anchor the strings at a point on the string holder member spaced on the opposite side from the second critical point on the bridge elements. This arrangement presents serious problems for this tremolo device:

- the length of the string subject to stretch beyond scale length, which includes the additional string length as measured from the bridge element to the anchoring point, is increased excessively in general at initial position and far more so when the device is pivoted in view of Rose U.S. Pat. No. 4,171,661 and,
- tensioning of the strings which holds the ball end of the string securely against the rear end opening of the string holding member is inadequate to keep the ball ends as originally seated in initial position throughout the performance range of the tremolo; such mis-seatings are devastating to the effort to maintaining a tuned instrument.

#### SUMMARY OF THE INVENTION

Accordingly, an object of this invention is to provide improvements in the mounting means of the bearing and bearing housing arrangement for pivotally supporting the base plate of the fulcrum tremolo that will allow a greater range of installation possibilities.

It is a further object of the invention to provide the intonation modules with macro-tuners, a string anchoring means, known to those skilled in the art as a tailpiece, and a separate string holder element that functions to additionally secure the string adjustably to the fulcrum tremolo at an additional point and an adjustment bolt threadedly engaged with the string holder element for positioning the string holder element relative to the second critical point for macro-tuning. The string holder element includes a string gripping means in the form of a fork-like element or collet. The string gripping means is disposed within the intonation module structure that grips and secures the string as close as possible to the second critical point in order to limit the length of string that would otherwise be subject to stretch and provides for an anchoring means that remains stable through the performance range of the

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tremolo. By operating the adjustment knob, the string holder element is displaced, thereby simultaneously:

- increasing the tension of the associated string to a proper pitched condition and varying the tension of the string thereof so as to provide the macro-tuning function of the intonation module, and
- drawing the string gripping means of the string holder element within a restricted portion of a sleeve-like portion of the intonation module structure, compressing and closing the string gripping means upon the string at the clamping point for transferring the anchoring of the string to an improved anchoring means at the end of the string holder element closest to the second critical point.

Yet, another object of the invention is to provide a global tuning mechanism on the fulcrum tremolo that compensates for the problems associated with varying humidity on the instrument as well as other factors that could affect the instrument's geometry. Further, a global tuner would also provide a simple and quick means for the musician to adjust the initial position in order to meet the pitch requirements in varied situations. Further, the global tuner in re-establishing the initial position allows the full range of pivoting the tremolo. Global tuners refer to a means on a fulcrum tremolo with the capacity to adjust the equilibrium point between tension of the counter spring(s) and the tension of the strings in order to compensate for changes in tension requirements on the strings and/or the counter springs. The global tuner preferably employs an adjustment knob for providing continuously variable adjustment of the tension in the strings by varying the relative distance between the spring attachment means on the base plate of the tremolo and the attachment point of the springs to the body.

Another object of the invention is to replace the fine tuner portion on each of the L-shaped arms of the "semi-headless" tuners with macro-tuner mechanisms and, therefore, provide for greater range and easier use. This advancement for adjustably securing each string to a improved clamping means

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positioned within a sleeve-like portion on one end of a L-shaped arm provides the capacity to tune the string from an tensioned condition to pitched string condition. Each L-shaped arm can pivot and be selectively positioned to a number of pre-set positions relative to the nut or first critical point for raising  
5 from an untensioned to a pre-set pitched string condition.

Yet another object of the invention is to provide a fulcrum tremolo having alternate string anchoring points that are spaced apart from one another. One anchoring point is provided at the bottom of the spring block or spring blade so that the anchoring point is remote from the second critical  
10 point. The second anchoring point is located adjacent the second critical point so that the length of string between the second critical point and the string anchor is substantially shorter when the string is anchored at the second anchoring point than at the spring block anchoring point. Specifically, the second anchoring point is located a distance from the second critical point that  
15 is substantially equal to the length of the wrappings on the end of the strings.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had by  
20 the accompanying drawings and descriptive matter in which there are illustrations and described preferred embodiments of the invention.

#### DESCRIPTION OF THE DRAWINGS

The foregoing summary as well as the following detailed description of  
25 the preferred embodiment of the present invention will be better understood when read in conjunction with the appended drawings, in which:

FIG. 1 is a plan view of an electric guitar embodying the present invention.

FIG. 2 is a perspective view of the macro-tuners, bearing mounting  
30 arrangement and global tuner of the present invention as used in the electric guitar.

FIG. 3 is a side view cross-section of the tremolo mechanism showing

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the macro tuners, bearing mounting arrangement and the global tuner.

FIG. 4 is a top view cross-section of the ball bearings, the housing mounting means.

FIG. 5 is an exploded perspective view of the bearing ball bearings, the  
5 housing mounting means.

FIG. 6 is a side view of the "semi-headless tuners" with two macro-tuning means.

FIG. 7 is a top view of the "semi-headless tuners" attached to the neck of the guitar.

10 FIG. 8 is a cross-section view of the side of a macro-tuning mechanism.

FIG. 9 is an enlarged fragmentary side view of an alternate embodiment of a global tuning mechanism.

Fig. 10 is a plan view partially in section of the global tuning mechanism illustrated in FIG 9.

15 Fig. 11 is a perspective view of an alternate embodiment of a fulcrum tremolo according to the present invention. base plate for a fulcrum tremolo

## DETAILED DESCRIPTION OF THE INVENTION

In FIG. 1, an electric guitar 1 is illustrated comprising a head 2 at one  
20 end, a body 3 at the other end, with a neck 4 extending between the head and the body. Six strings 6 extend from head 2 to body 3 over neck 4. Neck 4 forms fret board 5 for guitar 1. At head 2, each of the strings extends over nut 7 forming the first critical point for the strings. Nut 7 is located at the transition of neck 4 to head 2. Each string 6 is secured on the head by anchor  
25 8 and each anchor has a corresponding tuner 9. On the body 3, strings 6 are secured to fulcrum tremolo 12. Fulcrum tremolo 12 has arm 11 for pivoting the tremolo and providing the vibrato effect on the strings. Fulcrum tremolo 12 has six intonation modules 13. The intonation modules present  
30 improvements to the macro-tuning invention which incorporates the function of the bridge element and tail-piece in its structure as well as the capacity to adjustably secure the individual strings to the instrument. The intonation modules are movable and thereby provide a means to change the distance

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between the first and second critical points or the harmonic tuning as such.

The invention is shown for us on electric guitar 1 and it should be understood that the invention could be used on a variety of stringed musical instruments. In body 3 of guitar 1 there are electric pickups. Fulcrum  
5 tremolo 12 forms a second critical point for strings 6, sometimes characterized as an intonation point or bridge point.

In the following description, fulcrum tremolo 12 will be described in greater detail. In FIG. 2, fulcrum tremolo 12 is shown on an enlarged scale compared to FIG 1. FIG 3 displays fulcrum tremolo 12 of FIG 2 in a  
10 cross-section view. The second critical point is located near the front intonation modules 13. Outwardly from intonation modules 13 on each side of the opposite sides of base plate 14 extending in the direction of the strings there are bearing housings 30. The bearing housing 30 supports base plate 14 pivotally relative to body 3. Global tuner 50 is positioned between spring  
15 block 40 extending downwardly from the bottom of base plate 14 and counter springs 44 connected to instrument body 3.

In FIGS. 2 and 3, one of the intonation modules 13 is shown including a shaped barrel-like base 10 with a second critical point formed at string opening 17. Base 10 is adjustably secured to base plate 14 of fulcrum tremolo  
20 12 by machine screws 28 through slots 29. Loosening machine screws 28 permits longitudinal movement of base 10 and associated parts for harmonic tuning of string 6. Adjustment bolt 18 first passes through opening 20 in base 10 and threaded portion 19 of adjustment bolt 18 is engaged with threaded portion 21 of string holder element 22 within enlarged recess 23 of base 10.  
25 String 6 of the musical instrument makes critical contact with base 10 at the string opening 17 to passageway 15 sloping downwardly and rearwardly through base 10 until the string passes into enlarged recess 23. String 6 continues passing through clamping point 16 of string holder element 22, through slots 25 between upper fork 72 and lower fork 73 of fork-like string  
30 clamping means 24, through string passageway 27 of string holder element 22 and is secured at exit 26. Annular flange-like portion 71 of fork-like string clamping means 24 of string holder element 22 is in bearing contact with

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restricted portion 70 of enlarged recess 23 of base 10. Threading adjustment bolt 18 displaces the string holder element 22 relative to string opening 17 providing an adjustment whereby tension or pull on string 6 is applied and varied for raising and adjusting the strings 6 from an untensioned condition to a pitched string condition; additionally, annular flange-like portion 71 of fork-like string clamping means 24 of string holder element 22 is drawn within restricted portion 70 of enlarged recess 23, clamping string 6 between upper fork 72 and lower fork 73 at clamping point 16 as close as possible to string opening 17.

In FIGS 2, 3, 4 and 5 outwardly from intonation modules 13 on each side of the opposite sides of base plate 14 shown at the forward end of fulcrum tremolo 12 extending in the direction of the strings, there is bearing housing 30. Bearing housing 30 is adjacent to base plate 14. Housing 30 is adjustably supported relative to body 3 of the instrument by threaded post 31 with annular flange 32. Post 31 is threaded into insert 33 in body 3. By threading post 31 into insert 33, the spacing between body 3 and housing 30 is selectively adjustable. Adjustment of post 31 is effected through an oval opening 34 in the top of housing 30. In housing 30 rearward post 31, there is opening 76 extending transversely of the string direction of guitar 1 containing bearing assembly 35, formed by four side-by-side roller bearings 36. Insert 37 fits into cut-out 38 in the side of base plate 14 with pin 39 with annular flange 39a extending outwardly through bearings 36. Annular flange 39a on pin 39 spaces the side-by-side roller bearings 36 from base plate 14. Accordingly, by manipulating tremolo arm 11, fulcrum tremolo 12 can be pivoted about pin 39 to achieve the desired tremolo effect.

As can be seen in FIGS. 2 and 3 there is spring attachment means 40 extending downwardly from base plate 14. The preferred embodiment incorporates thumb screw 42 with shaft 45 threadedly engaged with threaded opening 47 in spring block 40 on one side of thumb screw 42 and another shaft 46 with reverse threads in the opposite direction of shaft 45 threadedly engaged with reverse threaded opening 48 in spring holder 41. Counter springs 44 are attached at one end to spring holder 41 and to body 3 on the

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other end of counter springs 44. Guide pin 43 extending outwardly from spring block 40 towards spring holder 41 passes through guide pin opening 49 in spring holder 41 limiting longitudinal rotational movement of spring holder 41 relative to spring block 40. By threading thumb screw 42 clockwise  
5 relative to spring holder means 41, spring holder 41 moves closer to spring block 40 increasing the tension of the counter springs 44 and by threading thumb screw 42 counter-clockwise relative to spring holder means 41, spring holder 41 moves away from spring block 40 decreasing the tension of the counter springs 44 providing the means to adjust the equilibrium point and  
10 globally tune fulcrum tremolo 12.

FIG. 6 displays an improved "semi-headless" tuner arrangement for stringed musical instruments. In FIG. 7, the end of neck 4 is shown with strings 6 each of a different size. The strings 6 pass over nut 7 and each string is secured by string tensioning tuning device 51, a "semi-headless tuner".  
15 There is a separate macro-tuning device 52 for each string.

The device, as set forth in FIGS 6 & 7 includes bracket 53 secured to and projecting from the end of neck 4. L-shaped lever 54 is pivotally connected by pin 55 as shown in FIG 6. The other or second arm 56 of lever 54 extends from pivot pin 44 toward the end of neck 4.

20 At the end of second arm 56 there is sleeve-like portion 57. String slot 58 extends longitudinally along sleeve-like portion 57 continuing disposed at an angle towards the top of the sleeve. Slot 59 at the free end of the sleeve extends towards the connected end of second arm 56.

Adjacent the free end and within sleeve-like portion 57, there is string  
25 clamping means 60 with fork-like portion 61 with upper fork 62 and lower fork 63 and at the opposite end there is threaded opening 64. Thumb screw 65 passes through slot 59 in sleeve-like portion 57 and through unthreaded opening 66 in upper fork 62 and is threadedly engaged with threaded opening 67 in lower fork 63. String 6 is arranged through slotted opening 58 and into  
30 slotted opening 75 between upper fork 62 and lower fork 63. Threading thumb screw 65 clamps the upper fork 62 and lower fork 63 on string 6, securing string 6 to string clamping means 60.

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Adjustment bolt 68 is adjustably mounted within sleeve-like portion 57 opposite the free end. Threaded portion 69 of adjustment bolt 68 is threadedly engaged with threaded opening 64 adjustably securing string clamping means 60 to macro-tuner 52. By threading adjustment bolt 68 the clamping means  
5 can be displaced relative to nut 7 wherein the tension on string 6 can be raised and varied whereby the macro tuning can be achieved.

Referring to Fig. 8, a single macro-tuning device is shown in which string 6 passes through slots 58 of sleeve-like portion 57 and is arranged between upper fork 62 and lower fork 63 of fork-like portion 61 of string  
10 clamping means 60 and clamped and secured by thumb screw 65 wherein threaded portion 69 of adjustment bolt 68 is threadedly engaged with threaded opening 64 of string clamping means 60. By threading adjustment bolt 68 the position of string clamping means 60 relative to the anchoring means at the opposite end string 6 is increased and varied whereby tension or pull on string  
15 6 is applied and varied for raising and adjusting the strings 6 from an untensioned condition to a pitched string condition.

Referring now to Figs. 9-10, an alternate embodiment of a global tuner 150 is illustrated. The global tuner 150 is shown in connection with a fulcrum tremolo having an integral base plate and spring blade 140 similar to the  
20 fulcrum tremolo shown in Fig. 11 and described below. Alternatively, the global tuner may be incorporated into a fulcrum tremolo having a separate base plate and spring block or spring blade.

The global tuner 150 includes a spring blade 140 connected to the base 14 of the tremolo, and extending into a cavity in the body 3 of the musical  
25 instrument. A plurality of counter springs 44 bias the tremolo against the tension in the strings. The springs are connected at one end to the body 3 of the instrument. The second end of each spring is connected to a spring holder 141. The spring holder 141 has a plurality of sockets, each of which receives the second end of one of the springs. An internally threaded aperture extends  
30 through the thickness of the spring holder, and is aligned with an aperture through the thickness of the spring blade 140. A thumbscrew 142 extends through the aligned apertures in the spring blade 140 and the spring holder



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141, threadedly engaging the spring holder. Preferably a low friction element, such as a teflon washer 148 is disposed about the shaft 145 of the thumbscrew 142, between the head of the thumbscrew and the spring blade 140.

Additionally, preferably, the spring holder 141 includes a pair of alignment  
5 tabs 143 integral with the body of the spring holder. The alignment tabs 143 mate with cooperating apertures in the lower end of the spring blade 140 to prevent vertical and lateral relative movement between the spring blade and the spring holder, while allowing longitudinal relative movement between the  
10 spring blade and the spring holder. Additionally, the lowermost edge of the spring blade 140 includes a plurality of notches or recesses for receiving the anchoring ball 160 at the end of the instrument strings if desired. If a plurality of macrotuners is utilized as described above, then the anchoring balls are engaged by the macrotuners. As in the previous embodiment, by turning the thumbscrew 165, the extension of the springs 144 is varied, which in turn  
15 varies the bias in the springs 144, thereby globally tuning all of the strings simultaneously.

Referring now to Fig. 11, an alternate fulcrum tremolo 210 having a base plate 220 that incorporates an integral spring blade 240 is illustrated. The base plate 220 is generally planar having a horizontal bore through the width  
20 of the base plate. A rod 222 extends through the horizontal bore and is supported at both ends by ring bearings 223 located within two bearing housing. For clarity, only one bearing housing is illustrated in Fig. 11. The rod 222 forms the fulcrum axis for the fulcrum arm, so that the fulcrum tremolo is pivotable about the rod 222. An adjustment screw 224 threadedly  
25 engages the bearing housing 223. The adjustment screw 224 vertically displaces the fulcrum axis and the base plate relative to the body of the musical instrument. The adjustment screw 224 is substantially aligned with the pivot axis so that the pivot axis intersects the vertical axis of the adjustment screw. Alternatively, as shown in Figs. 3 and 4, the pivot axis may be  
30 rearwardly spaced from the adjustment screw.

The base plate 220 includes a plurality of sockets 225 for connecting intonation modules to the base plate. In the present instance, the sockets 225

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are threaded so that a screw can be used to connect intonation modules to the base plate. The present base plate is configured to receive six intonation modules. However, the base plate can be configured to receive a different number of intonation modules for different application. For clarity, in Fig. 11 only, a single intonation module 170 is illustrated. The intonation module in Fig. 11 simply comprises a bridge element. Alternatively, the intonation module can incorporate a macrotuner as discussed above and illustrated in Fig. 8.

The intonation module 170 is connected to the base plate 220 by an attachment screw 172 that threadedly engages a threaded socket 225 in the base plate. An alignment pin 175 projects from the button of the intonation module 170 and engages a longitudinally elongated slot 230 in the base plate. The base plate includes similar slots and threaded sockets for attaching five similar intonation modules.

The intonation module 170 includes a longitudinally elongated slot 173 for receiving the attachment screw 172. The elongated slot 173 allows longitudinal adjustment of the intonation module 170, which adjusts the position of the bridge element that forms the second critical point for the corresponding string. Accordingly, the second critical point can be moved toward or away from the first critical point by loosening the attachment screw 172 and moving the intonation module. The ends of the slot 173 in the intonation module 170 form forward and rearward stops limiting the longitudinal movement of the intonation module. The sides of the slot 230 that receives the alignment pin 175 form side stops limiting lateral movement of the intonation module. In addition, preferably the base plate includes an adjustment screw 229 for adjusting the longitudinal position of the intonation module.

The base plate is operable with intonation modules that include a macrotuner as described above. Such intonation modules provide an anchor for anchoring the anchoring ball or string anchor 160 that is at the end of the string. Alternatively, an intonation module that provides two alternate string anchoring points can be utilized. Such an intonation module 170 is illustrated

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in Fig. 11.

The spring blade 240 provides the first anchoring point for the string anchor. The string anchor 160 is seated in one of the notches at the bottom of the spring blade 240. The string extends upwardly through an elongated  
5 cylindrical passageway in the spring blade. The string then passes through an opening in the spring blade referred to as string passageway 242. From the string passageway 242 the string passes through the string hole 227 in the base plate 220. The string then passes through the intonation module 170 and over the second critical point.

10 The rearward surface 177 of the intonation module 170 provides the alternate anchoring point. As shown in Fi. 11, the string can be anchored to the end of the intonation module so that the string anchor 160 bears against the rearward outer surface 177 of the intonation module. This alternate anchoring position is illustrated in phantom in Fig. 11. A hole or alternatively a slot is  
15 located in the rearward end of the intonation module. The hole or slot is narrower than the width of the string anchor 160, but wider than the diameter of the string. The string extends through the hole or slot and the string anchor 160 bears against the rearward surface to anchor the string

The intonation module 170 is configured so that the distance from the  
20 rearward outer surface 177 of the intonation module to the second critical point is approximately equal to the length of the wrapping of the string, the length of the wrapping being slightly less than the distance between the second critical point and the rearward surface of the intonation module. In this way, the wrapping of the string does not engage the second critical point. Further, the  
25 length of the string rearward of the second critical point is substantially inextensible.

Accordingly, the intonation module provides alternate anchoring points. Connecting the strings so that the string anchors 160 are anchored at the bottom of the spring blade 240 provides for an extended length of string  
30 rearward of the critical point that is subject to stretch so that the fulcrum tremolo creates a "looser" feel for the user. Alternatively, the strings can be anchored to the rearward end of the intonation module.

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The base plate 220 may be substantially planer. However, in the present instance the base plate is multi-tiered, having five tiers for receiving the intonation modules. The first tier 221a receives the sixth intonation module. The next tier 221b is approximately 0.020 inch higher than the first tier 221a, and it receives the fifth intonation module. The third tier 221c is approximately 0.020 inch higher than the second tier 221b, and it is approximately twice as wide as the second tier, so that the third tier is sized to receive the third and fourth intonation modules. The fourth tier 221d is approximately 0.020 inch lower than the third tier 221c, so that the fourth tier is substantially the same height as the second tier 221b. The fourth tier 221d receives the second intonation module. The fifth tier 221e is approximately 0.020 inch lower than the fourth tier 221d, so that the fifth tier is substantially the same height as the first tier 221a. The fifth tier receives the first intonation module, which is illustrated in Fig. 11.

As noted above, the spring blade 240 is integrally formed with the base plate 220. The spring blade 240 projects transverse vertically downwardly from the base plate 220. A reinforcing rib 245 extends transverse the spring blade 240 and the base plate 220, connected to the spring blade and the base plate. In the present instance the reinforcement rib 245 is integral with the spring blade 240, and a fastener 246, such as a screw, connects the reinforcement rib to the base plate 220. The lower portion of the spring blade 241 forms an angle with the upper portion of the spring blade 240. At least one spring socket 243 is formed into the lower portion of the spring blade 241. The spring socket 243 is a generally cylindrical cavity for receiving the end of a spring that is connected to the body of the instrument. The spring biases the tremolo against the tension in the strings as discussed above. Alternatively, a global tuner similar in construction to the global tuner 50 described above can be utilized. Such a global tuner is disposed between the spring blade 240 and the spring to alter the bias that the spring applies to the spring blade.

The base plate 220 and spring blade 240 are integrally formed from a single piece of material as follows. A single piece of plate material, such as 7/64" plate steel is provided. The plate is stamped to form the multiple tiers

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221a-e. The forward edge of the plate is folded over on itself to form a ridge across the central portion of the width of the plate that is at least twice the thickness of the plate material. A plurality of fasteners, such as screws rigidly connect the two layers of the ridge to one another. The bore of the fulcrum axis is then formed in the ridge, preferably by drilling the bore laterally through the width of the ridge.

Two parallel spaced-apart slots are formed in the plate. The slots extend forwardly from the rearward edge of the plate and terminate rearwardly from the forward edge of plate. The portion of the plate between the slots forms the spring blade 240. The portion of the plate forward of the terminated slots forms the base plate 220. The reinforcing rib 245 is cut from the portion of the plate that forms the spring blade 240. One edge of the reinforcing rib is left uncut, so that the reinforcement rib is integral with the spring blade 240.

The spring blade is formed by bending the portion of the plate between the two terminated slots vertically downwardly, so that the spring blade is transverse the base plate 220, projecting downwardly and forwardly toward the forward edge of the base plate. The width of the spring blade 240 is narrower than the width of the base plate 220 so that bending the plate to form the transverse spring blade forms two spaced-apart tabs 228 extending rearwardly from the base plate, integral with the base plate, and straddling the spring blade. The lower portion of the spring blade 241 is then bent transverse the upper portion of the spring blade, so that the lower portion 241 projects downwardly as shown in Fig. 11, so that string passageway 242 aligns with the string holes 227 in the base plate 220.

The reinforcement rib 245 is bent about the line forming the uncut edge of the reinforcement rib. The rib 245 is then attached to the lower surface of the base plate. In the present instance, the rib 245 is connected to the base plate 220 by a fastener, such as a screw 246, extending through the base plate and into an internally threaded portion in the rib.

In this way, the tremolo base plate 220 is integrally formed with the spring blade 240 from a single piece of material, so that a single unitary component connects the tremolo to the spring that biases the tremolo against

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the tension in the instrument strings.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without

5 departing from such principles.

**That which is claimed is:**

1. Tuning apparatus for a stringed musical instrument comprising a body and a neck extending outwardly from said body, a plurality of strings extending from said body to said neck, means for forming a first critical point for each of said strings on said neck, means for forming a second critical point for each of said strings on a fulcrum tremolo, said fulcrum tremolo includes a base plate, said base plate being pivotally mounted about a fulcrum axis extending transversely of said strings for changing the pitch of all said strings at one time as said base plate is pivoted, separate means for mounting each of said strings on said base plate and for raising and adjusting the tension of said strings from an untensioned condition to a proper playing pitch including means for varying the spacing between said first and second critical points for changing the harmonic tuning, wherein the improvement comprises that each of said separate means for mounting each of said strings has a bridge element forming said second critical point and a string holder means on opposite side of said bridge element from said first critical point disposed in a variably spaced relation to said second critical point over which each of said string extends.
2. Apparatus as set forth in claim 1 wherein said separate means has a sleeve-like member, said sleeve-like member has a first portion closer to said second critical point and a second portion more remote from said second critical point, said sleeve-like member includes a restricted interior portion between said first and second ends thereof, said string holder means has a first end closer to said bridge element and a second end more remote from said bridge element, said string holder means is displaceable between a first limiting position and a second limiting position and the first end of said string holder means is in spaced relation from said bridge element in and between said first and second limiting positions, and said restricted portion so arranged to receive said

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separate means operable to impede rotation of said sleeve-like member in one direction without additional means.

3. Apparatus as set forth in claim 2 wherein string holder means has a string passageway extending from the first end thereof toward the second end, said string arranged to extend through said string passageway and secured to said string holder means at said second end.
4. Apparatus as set forth in claim 3 wherein said string holder means has a threaded portion extending in the direction of the first end from said second end of said string holder means, said string holder means has a string clamping means extending from said first end of said string holder means towards said threaded portion, and said string holder displacement means comprising an bolt-like member adjustably mounted in said separate means and arranged to threadedly engage said string holder means for displacing said string holder means between said first and second limiting positions.
5. Apparatus as set forth in claim 4 wherein said string clamping means has a fork-like slotted string passageway extending from said threaded portion to said first end of said string holder means, said string clamping means including a clamping point at first end of said string holder means, said fork-like slotted string passageway has a lower fork closer to said base plate and an upper fork more remote from said base plate, said string clamping means has a annular flange-like portion in bearing contact with said restricted interior portion of said sleeve-like member, said string arranged to extend through said string passageway between said upper and lower forks, wherein as said string holder means is displaced in and between said first and second limiting positions for macro-tuning said string, said upper and lower forks are simultaneously displaced towards said string within said restricted interior portion for anchoring said string at said clamping point.



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6. A stringed musical instrument comprising an elongated neck and body attached to one end of the said neck, a tremolo device mounted on said body, a plurality of elongated strings, means on said neck for supporting and forming a first critical point for each of said strings, said tremolo device forming a support for and second critical point for each of said strings, said tremolo device comprising a fulcrum tremolo, said fulcrum tremolo including bearing means mounted on said body and supporting said fulcrum tremolo for pivotal displacement, said bearing means comprises at least one ball bearing and at least one bearing housing for adjustably positioning said bearing means relative to said body and at least one shaft is connected to said base plate through said ball bearing wherein the improvement comprises an annular flange on said shaft which spaces said bearing means away from said base plate.
7. A stringed musical instrument comprising an elongated neck and body attached to one end of the said neck, a fulcrum tremolo mounted on said body, a plurality of elongated strings, means on said neck for supporting and forming a first critical point for each of said strings, said fulcrum tremolo forming a support for and second critical point for each of said strings, said fulcrum tremolo including counter springs with a first end closer to said second critical point and a second end further from said second critical point, said first end of said counter springs connected to said body and said second end of said counter springs connected to an attachment means on said fulcrum tremolo for counter balancing the tension of said elongated strings wherein the improvement comprises that said attachment means includes a separate means for globally tuning said fulcrum tremolo.
8. Apparatus as set forth in Claim 9 wherein said separate means comprises a spring holder means disposed in spaced relation between said first end of said counter springs and said attachment means.

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9. Apparatus as set forth in claim 8 wherein said spring holder means is displaceable between a first limiting position and a second limiting position and said spring holder means is in spaced relation from said attachment means in and between said first and second limiting positions.
10. Apparatus as set forth in claim 9 wherein said attachment means has a threaded passageway extending in the direction of said spring holder means, said spring holder means has a threaded passageway extending in the direction of said counter springs and an unthreaded passageway extending in the direction of said attachment means, and said string holder displacement means comprises a thumb screw-like member arranged with a first threaded portion extending in the direction of said counter springs and a second threaded portion extending in the direction of said attachment means.
11. Apparatus as set forth in Claim 10 wherein said first threaded portion of said thumb screw-like displacement means is threadedly engaged with said threaded passageway of said spring holder means and said second threaded portion of said thumb screw-like displacement means is threadedly engaged with said threaded passageway of said attachment means for displacing said string holder means in and between said first and second limiting positions.
12. Apparatus as set forth in claim 11 wherein said attachment means has a pin extending in the direction of said spring holder means and said pin passes through said unthreaded opening of said spring holder means for limiting the rotation of said spring holder means about said thumb screw-like displacement means.
13. In a stringed musical instrument, means for locking and tensioning at least one string from an untensioned condition to a tuned pitched

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condition at one end of the neck of a stringed musical instrument, said means comprising a string locking means for said at least one string, a bracket secured to said one end of said neck, a lever pivotally secured to said bracket, said string locking means secured to said lever, said lever is L-shaped comprising a first lever arm extending angularly from a second lever arm and said lever arms secured together at an intersecting section and a pivot pin extending through said intersecting section and said bracket for pivoting and securing said lever to said bracket, a locking clamp for adjustably securing said second lever arm to said bracket, said first lever arm has a free end spaced from said intersecting section, wherein the improvement comprises that said first lever arm includes an string holder means for securing and macro-tuning said at least one string.

14. A tuning apparatus for a stringed musical instrument, a plurality of strings extending over said stringed musical instrument, each of said strings having a first end and a second end, each of said first end of said strings having a first anchoring means on a first section of said stringed musical instrument and each of said strings having a second anchoring means on a second section of said stringed musical instrument, separate means for raising and adjusting the tension of at least one string from an untensioned condition to a tuned pitched condition, wherein the improvement comprises that said separate means has a string securing means including said first anchoring means for macro-tuning said at least one string.
15. Apparatus as set forth in claim 14, wherein said string securing means has a first end closer to said second anchoring means and a second end further to said second anchoring means, said string securing means is displaceable between a first limiting position and a second limiting position and the first end of said string securing means is in spaced relation from said second anchoring means and in between said first and

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second limiting positions.

16. Apparatus as set forth in claim 15 wherein each said separate means includes a sleeve-like member with a first section closer to said second anchoring means and a second section closer said second anchoring means, said first end of said string securing means has a string passageway closer to said second anchoring means extending in the direction between said first and second ends thereof, said string securing means has a threaded portion further from said second anchoring means extending in the direction between said first and second ends thereof, and said string securing displacement means comprising an bolt-like member adjustably mounted in said sleeve-like member and arranged to threadedly engage said string securing means for displacing said string securing means in and between said first and second limiting positions.
17. Apparatus as set forth in claim 16, wherein said sleeve-like member has a first slot arranged in said first section thereof, a first side of said sleeve-like member associated with said first slot, said string securing means has a fork-like string passageway extending from said first end thereof towards said second end of said string securing means, said fork-like string passageway means has a upper fork closer to said first slot and an lower fork more remote from said first slot, said upper fork has an unthreaded passageway transverse the direction of said fork-like passageway, said lower fork has a threaded passageway transverse the direction of said fork-like passageway, said upper and lower forks are displaceable between an open position and a closed position.
18. Apparatus as set forth in claim 17, wherein said upper and lower fork displacement means comprising a thumb screw-like member adjustably arranged to pass through said first slot of said sleeve-like member, through said unthreaded passageway of said upper fork and threadedly

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engage said threaded passageway of said lower fork for displacing said upper and lower forks in and between said open and closed positions towards said string for clamping and securing said at least one string.

19. Apparatus as set forth in claim 18, wherein said sleeve-like member has a second slot extending from said first section of said sleeve-like member towards said second section thereof adjacent said fork-like string passageway and continuing disposed at an angle towards said first side of said sleeve-like member associated with said first slot wherein said at least one string is arranged to extend through said second slot and into said fork-like string passageway between said upper and lower forks.
20. Apparatus as set forth in claim 13 wherein string holder means for securing and macro-tuning said at least one string is said string securing means for macro-tuning said at least one string as set forth in claim 14.
21. Apparatus as set forth in claim 16, wherein said sleeve-like member includes a restricted portion between first and second section thereof, said string securing means has a string passageway extending from the first end thereof toward the second end, said string arranged to extend through said string passageway and secured to said string securing means, said string securing means includes a string clamping means, said string clamping means in and between said first and second ends of said string securing means, said string clamping means has a fork-like slotted string passageway extending from said threaded portion to said first end of said string securing means, said string clamping means including a clamping point at first end of said string securing means, said fork-like slotted string passageway has a first fork and second fork, said string clamping means has a annular flange-like portion in bearing contact with said restricted portion of said sleeve-like member, said string arranged to extend through said string passageway and between said first and second forks, wherein as said string clamping

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means is displaced in and between said first and second limiting positions said first and second forks are displaced within said restricted portion of said sleeve-like member for securely clamping said string at said clamping point.

22. Apparatus as set forth in claim 18 is part of a tremolo device wherein said first end of said string securing means is as close as possible to said second critical point.
23. A fulcrum tremolo for a stringed musical instrument having a head engaging the first end of the strings, the tremolo comprising:  
a base plate pivotable about a pivot axis;  
a string anchor engaging the second end of one of the strings;  
a bridge element connected to the base plate, pivotable about the pivot axis, engaging the one string intermediate the string anchor and the head;  
a macrotuner connected to the base plate rearward of the bridge so that the macrotuner is pivotable about the pivot axis, the macrotuner being operable to adjust the string from an untensioned pitch to a proper playing pitch, the macrotuner comprising:  
an elongated arm extending rearwardly adjacent the bridge element; and  
a gripping portion intermediate the bridge and the string anchor for gripping the string.
24. The tremolo of claim 23 wherein the tremolo comprises a ball bearing and the base plate is pivotable about the base plate.
25. A fulcrum tremolo for a stringed musical instrument having a head engaging the first end of the strings, the tremolo comprising:  
a base plate pivotable about a pivot axis;  
a string anchor engaging the second end of one of the strings;

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a bridge element connected to the base plate, pivotable about the pivot axis, engaging the one string intermediate the string anchor and the head;

a macrotuner rearward of the bridge, operable to adjust the string from an untensioned pitch to a proper playing pitch, the macrotuner comprising:

a gripping portion intermediate the bridge and the string anchor for gripping the string.

26. The tremolo of claim 25 wherein the macrotuner is connected to the base plate so that the macrotuner is pivotable about the pivot axis.
27. The tremolo of claim 25 wherein the macrotuner comprises an elongated arm extending rearwardly adjacent the bridge element.
28. The tremolo of claim 25 wherein the tremolo comprises a ball bearing and the base plate is pivotable about the base plate.
29. A fulcrum tremolo operable with a musical instrument having a body and a plurality of strings in a tensioned state connected to the body, the tremolo comprising:
  - a base mounted to the body, pivotable about a fulcrum axis, wherein the tension in the strings tends to pivot the base in a first direction about the fulcrum axis;
  - a tremolo arm operable to pivot the base about the fulcrum axis to create a tremolo effect;
  - a biasing element connected to the body wherein the biasing force of the biasing element tends to pivot the base in a second direction against the tendency of the base to pivot the base in a first direction in response to the tension in the strings; and
  - an adjustment mechanism disposed between the biasing element and the base, operable to adjust the biasing force of the biasing element.

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30. The device of claim 29 wherein the base includes an elongated arm and the adjustment mechanism operates to vary the distance between the arm and the biasing element.
31. The device of claim 29 comprising a block connected to the biasing element and an elongated arm connected to the base, wherein the adjustment mechanism threadedly engages at least one of the block and the elongated arm.
32. The device of claim 30 comprising an alignment element operable to impede rotation of the block in at least one direction relative to the elongated arm.
33. A tremolo operable with a musical instrument having a body and a plurality of strings in a tensioned state, connected to the body, the tremolo comprising:  
a base mounted to the body, pivotable about a fulcrum axis, wherein the tension in the strings provide a force in a first direction that tends to pivot the base in a first direction about the fulcrum axis;  
a tremolo arm operable to pivot the base about the fulcrum axis to create a tremolo effect;  
a counter balance producing a force in a second direction to counter balance the string tension force to establish an equilibrium point of rotation of the base;  
an adjustment mechanism operable to adjust the equilibrium point of rotation of the base.
34. The device of claim 33 wherein the adjustment mechanism varies the counter balance force.
35. The device of claim 33 wherein the base includes an elongated arm and

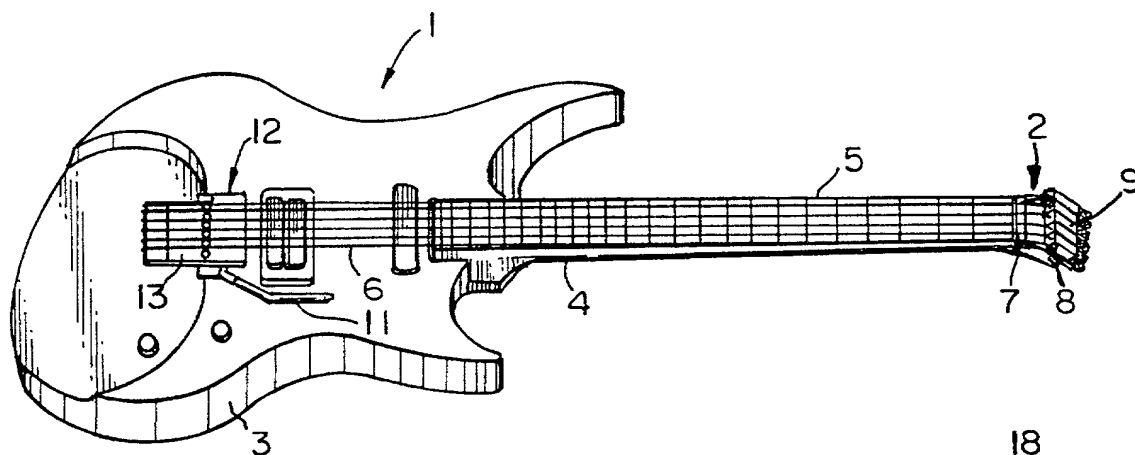
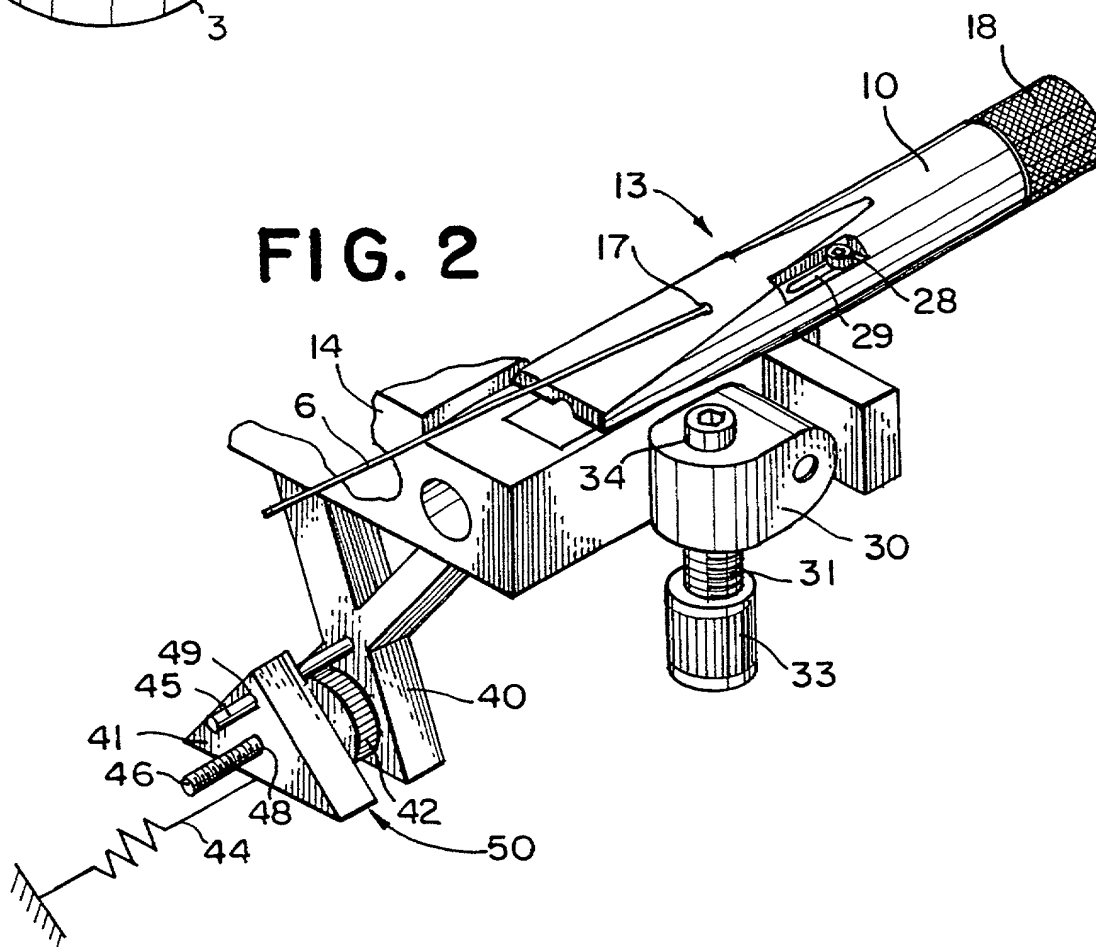


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the adjustment mechanism operates to vary the distance between the arm and the counter balance.

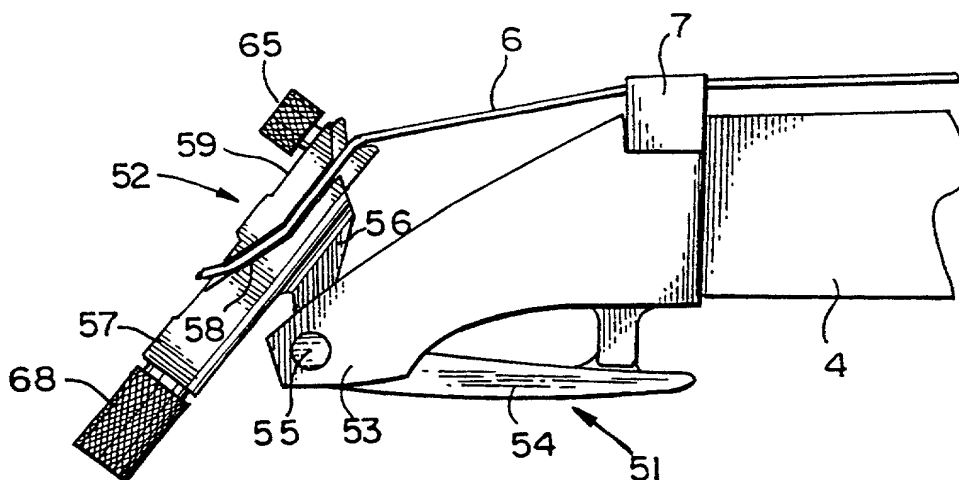
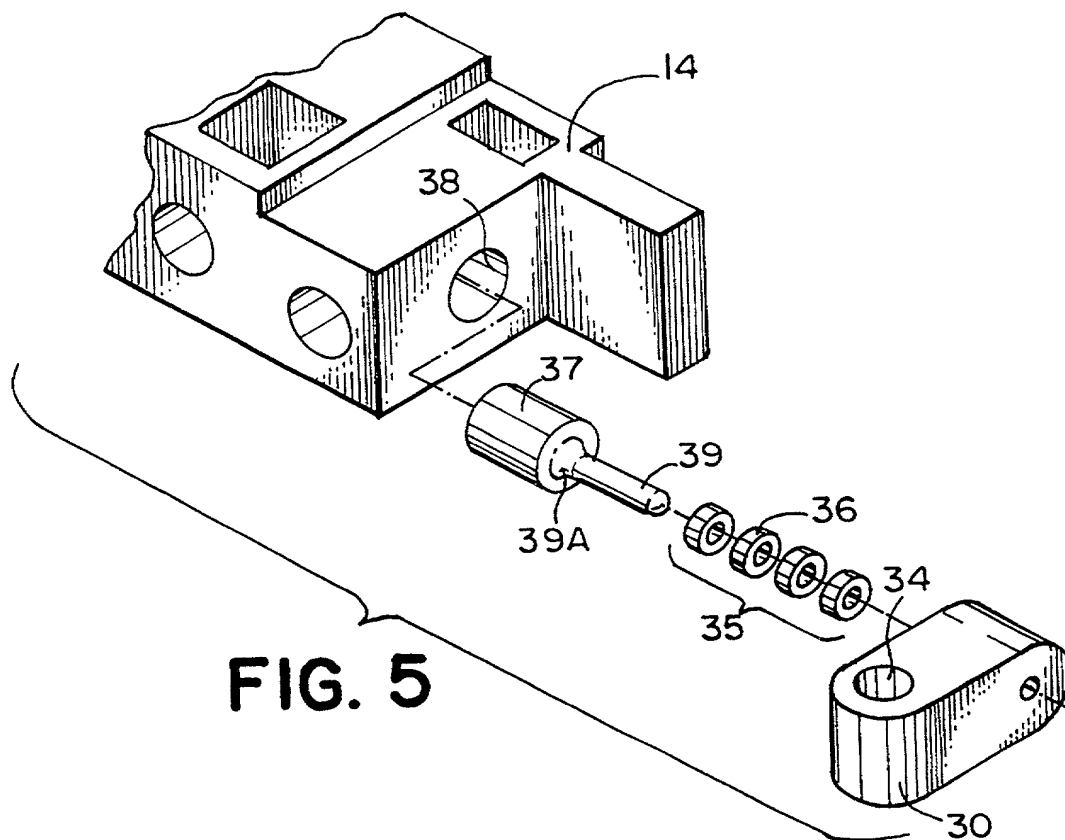
36. The device of claim 33 comprising a block connected to the biasing arm and an elongated arm connected to the base, wherein the adjustment mechanism threadedly engages at least one of the block and the elongated arm.
37. The device of claim 35 comprising an alignment element operable to impede rotation of the block in one direction relative to the elongated arm.
38. A tremolo operable with a musical instrument having a body and a plurality of strings in a tensioned state, connected to the body, the tremolo comprising:  
a base mounted to the body, pivotable about a fulcrum axis;  
a tremolo arm manually operable to pivot the base about the fulcrum axis to produce a tremolo effect;  
a tuning element connected with the base operable to simultaneously vary the tension in each of the strings.
39. A tremolo operable with a musical instrument having a body and a plurality of strings in a tensioned state, connected to the body, the tremolo comprising:  
a base mounted to the body, pivotable about a fulcrum axis;  
a tremolo arm manually operable to pivot the base about the fulcrum axis to produce a tremolo effect;  
a ring bearing rotatably supporting the base; and  
a vertical adjustment for vertically displacing the base, wherein the vertical adjustment is located parallel or forward of the pivot axis.

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**FIG. 1****FIG. 2**



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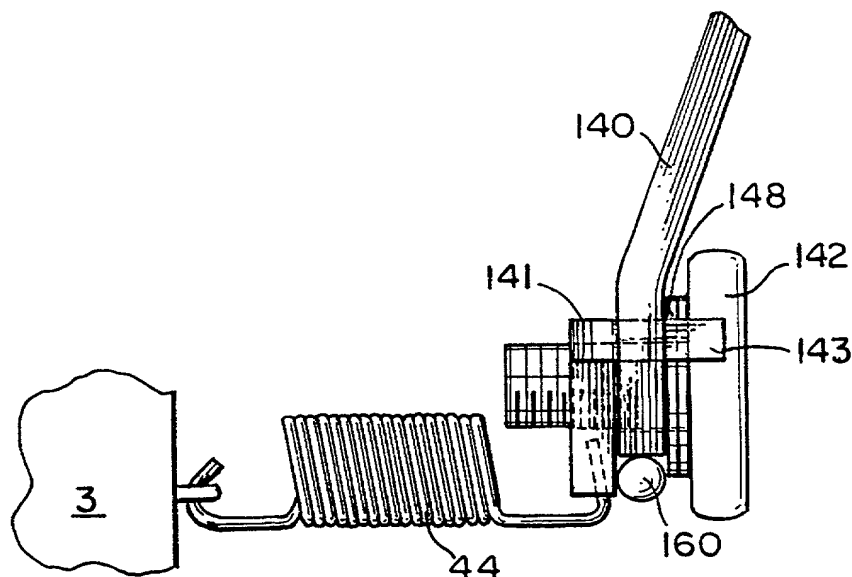
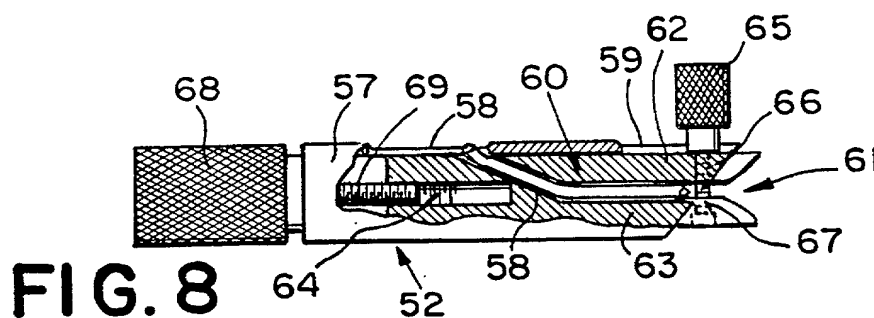
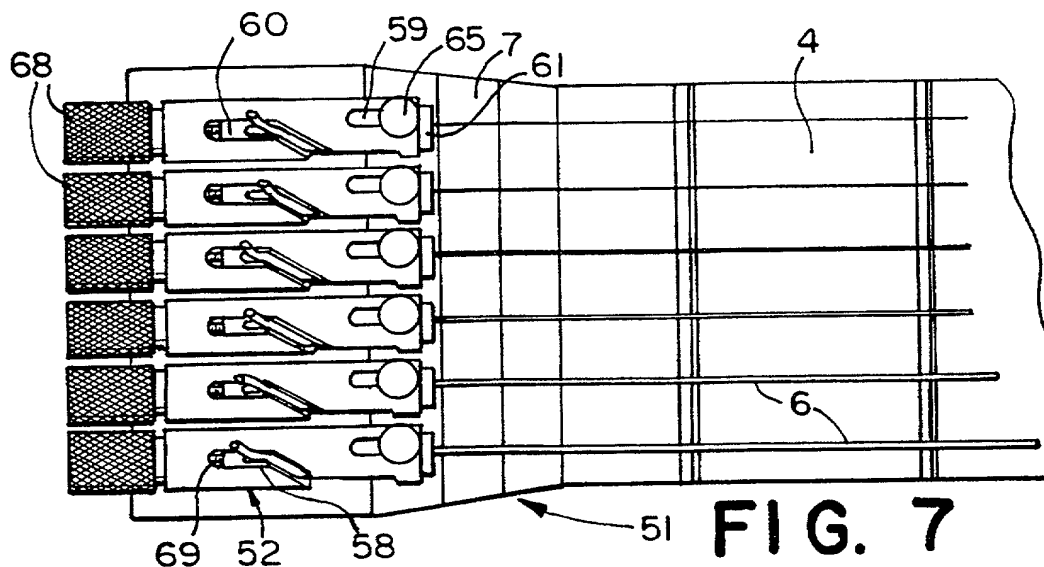


FIG. 9

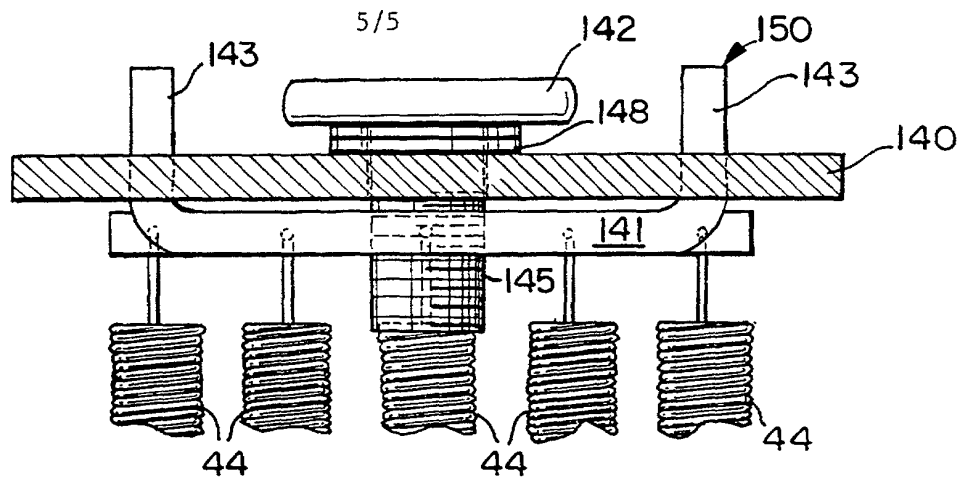


FIG. 10

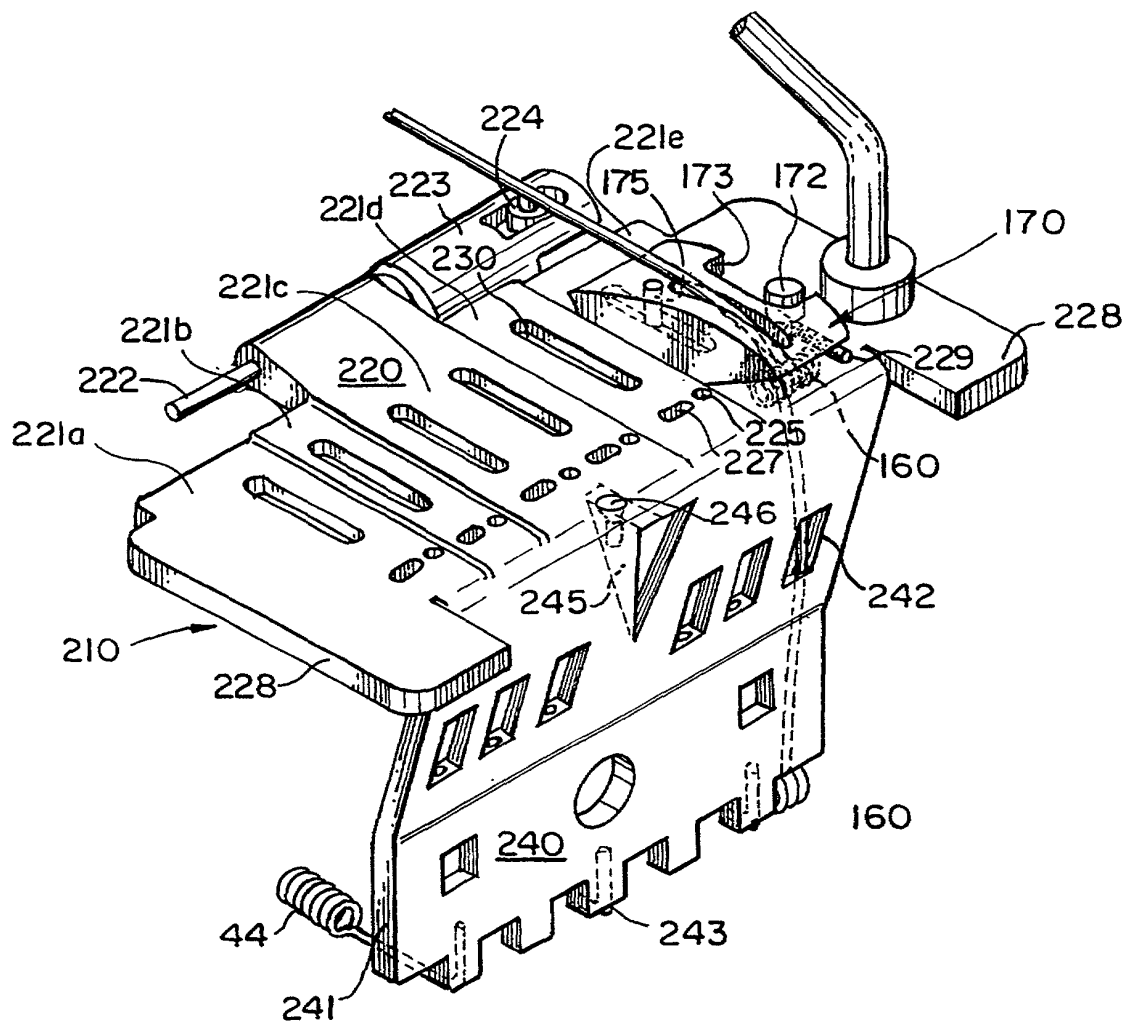


FIG. 11

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**DECLARATION FOR UTILITY OR  
DESIGN  
PATENT APPLICATION  
(37 CFR 1.63)**

☒ Declaration Submitted with Initial Filing  
OR  
☐ Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)

Attorney Docket Number

First Named Inventor

**COMPLETE IF KNOWN**

Application Number

Filing Date

Group Art Unit

Examiner Name

**As a below named inventor, I hereby declare that:**

My residence, mailing address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

*Tuning Apparatus for Stringed Instrument*

(Title of the Invention)

the specification of which

☐ is attached hereto

OR

☒ was filed on (MM/DD/YYYY)

*09/29/1998*

as United States Application Number or PCT International

Application Number *PCT/US98/20376* and was amended on (MM/DD/YYYY) (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

[Page 1 of 2]

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## DECLARATION — Utility or Design Patent Application

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

NAME OF SOLE OR FIRST INVENTOR : ☐ A petition has been filed for this unsigned inventor

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Inventor's Signature \_\_\_\_\_ Date \_\_\_\_\_

Residence: City \_\_\_\_\_ State \_\_\_\_\_ Country \_\_\_\_\_ Citizenship \_\_\_\_\_

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City \_\_\_\_\_ State \_\_\_\_\_ ZIP \_\_\_\_\_ Country \_\_\_\_\_

☐ Additional inventors are being named on the \_\_\_\_\_ supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto.